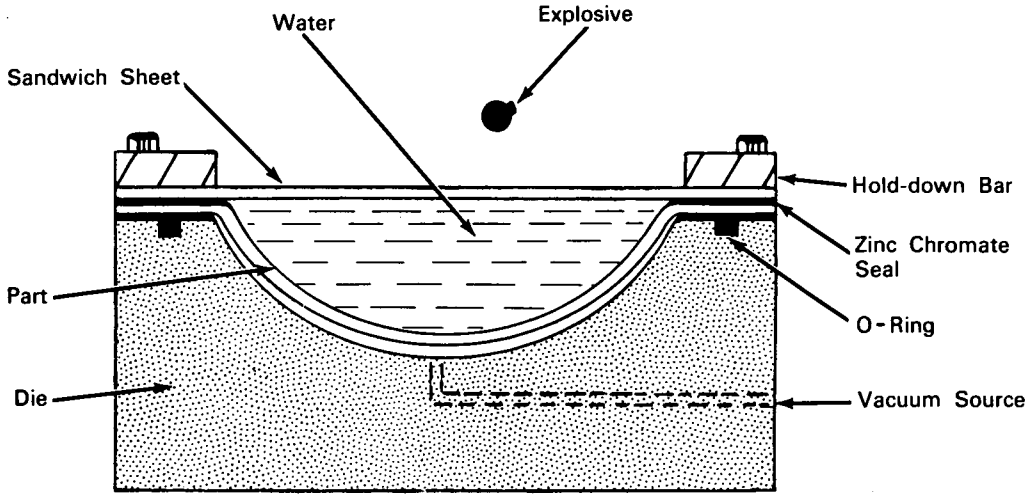
NASA TECH BRIEF

Metal Parts Hydrosized by Explosive Force



The problem: To size large metal parts where close, accurate dimensional tolerances are required. Conventional explosive forming consists of either restriking a part, using the explosive forces to size the part after forming, or of using a metallic blanket that acts as the die punch. These methods produce satisfactory parts only for ordinary operations to loose tolerances.

The solution: Parts are sized in an evacuated die that is a sealed container, completely filled with water above the part to be sized. The entire assembly is submerged in a suitable water-filled pit and a charge is exploded above the water. The principle of the incompressibility of water is used to perform the function of a die punch.

How it's done: The partially formed part is positioned in a suitable female die of forged steel or another material equivalent strength. An O-ring located at the interface of the die and flange area of the part gives a vacuum-tight seal. The cavity above the part is completely filled with water and a zinc chromate seal is placed over the flange area of the part. A metal sandwich sheet is installed over the entire assembly and bolted down, effectively sealing the water-filled cavity. The die area is evacuated to 29 inches of mercury and the assembly placed in a water-filled pit. The charge is then exploded immediately above the surface of the water in the pit. The force from the detonation is transmitted through the incompressible water and distributed evenly over the surface of the part.

Notes:

1. The sandwich sheet should be of sufficient strength to transmit the force without rupturing so that it may be used in repeated operations.

(continued overleaf)

2. In this method, pitting and damage to the surface of the part is avoided, force application is of longer duration and pressure more evenly distributed, and springback of the part is eliminated.
3. Explosive hydrosizing achieves the extremely close tolerances required in such applications as the manufacture of prototypes.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B65-10170

Patent status: NASA encourages the immediate commercial use of this invention. It is owned by NASA and inquiries about obtaining royalty-free rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

Source: North American Aviation, Inc., under contract to Marshall Space Flight Center (M-FS-289)